

TN-45 CR
OCIT
063191

**Workplan for Catalyzing Collaboration with Amazonian
Universities in the Large Scale Biosphere-Atmosphere
Experiment in Amazonia (LBA)**

Summary of research

NASA Research Grant number: NAG5-3478

I. Foster Brown and Adriana Moreira
fbrown@whrc.org and adriana@whrc.org
Principal Investigators

Period: 1 November 1996 - 31 December 1997

The Woods Hole Research Center
P.O.Box 296
Woods Hole, MA 02543

Introduction

Success of the Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) program depends on several critical factors, the most important being the effective participation of Amazonian researchers and institutions. Without host-country counterparts, particularly in Amazonia, many important studies cannot be undertaken due either to lack of qualified persons or to legal constraints. No less important, the acceptance of the LBA program in Amazonia is also dependent on what LBA can do for improving the scientific expertise in Amazonia.

Gaining the active investment of Amazonian scientists in a comprehensive research program is not a trivial task. Potential collaborators are few, particularly where much of the research was to be originally focused -- the southern arc of Brazilian Amazonia. The mid-term goals of the LBA Committee on Training and Education are to increase the number of collaborators and to demonstrate that LBA will be of benefit to the region. At the end of 1996 this committee included: Drs. Thelma Krug (chair, National Institute of Space Research), Paulo Artaxo Neto (University of Sao Paulo), Luiz Martinelli (Center for Nuclear Energy in Agriculture), Antonio Nobre (National Institute for Research in Amazonia), Jose Marengo (National Institute for Space Research), Foster Brown (Woods Hole Research Center/Federal Fluminense University), and Carlos Nobre (ex officio, National Institute for Space Research). Currently, Luiz Martinelli is chair of this committee.

The principal activities supported by this grant are : a) visits to 25 institutions in Brazilian Amazonia, and b) a workshop on training and education held in Manaus in March 1997.

Visits to Amazonian Institutions

Brazilian Amazonia is larger than western Europe and with greater problems of communication. Not surprisingly, information on LBA has been limited to individuals in a few institutions. The goal of this component of the grant was to present the LBA program to most of the research and higher education institutions in Amazonia and the nearby Cerrado.

The institutions visited prior to the workshop are listed in Table 1. These visits included presentations about LBA, discussions with heads of relevant departments, and distribution of literature about LBA. While the visits turned out to be extremely useful, many groups expressed doubt about the benefits of large-scale projects. These groups nearly always became enthusiastic about LBA when we pointed out the education and training component. We estimate that 200 to 400 persons attended our presentations.

Workshop on Education and Training

The second component of our activities culminated in a workshop on education and training held at the Hotel Tropical in Manaus from 23-27 March 1997. The report is in Appendix I and also available at the following web sites: <http://www.cptec.inpe.br/lba/reports/te-rep2.html>, or http://daacl.ESD.ORNL.Gov/lba_cptec/reports/te-rep2.html.

The most important results of the workshop are as follows:

- 1) A set of short courses to build interest and competence in LBA thematic areas were formulated. Four of these will occur during the next seven months;
- 2) A proposal to the National Research Council of Brazil (CNPq) for nearly 200 fellowships was outlined. This proposal has now been submitted;
- 3) A proposal to CNPq for a doctoral program in Global Change was proposed. This proposal, too, has been submitted;
- 4) A training program for Amazon Pact countries outside Brazil was proposed. The LBA office has recently received additional funding (\$100,000) from the Inter-American Institute for Global Change Research (IAI) for this program.
- 5) The participants proposed a global change program for Amazonian Institutions. This proposal is being developed and a concept paper has been circulated to funding agencies.
- 6) A network of contacts in several Amazonian states became a reality. The names and email addresses are in the Appendix.

The results of this workshop have proven to be extremely positive, with nearly all the proposals now being implemented. The challenge now is to link the education and training program with the research activities, particularly at the individual project level.

Table 1. List of Amazonian institutions visited prior to March workshop, the period of the visit, and who went.

Institution	Period	Who
1. Universidade Federal do Pará - UFPa	Aug 96/ Jan 97	Foster Brown/ Tatiana Sá (CPATU) /Gilberto Fisch (CTA)
2. Museu Paraense Emilio Goeldi- MPEG	idem	idem
3. CPATU/EMBRAPA	idem	idem
4. Faculdade de Ciências Agrárias do Pará - FCAP	idem	idem
5. Secretaria Estadual de Meio Ambiente do Amapá - SEMA	Jan 97	Tatiana Sá / Gilberto Fisch
6. Centro de Pesquisa Agroflorestal/EMBRAPA - Amapa CPAF-AP	idem	idem
7. Instituto de Pesquisa do Amapá- IEPA	idem	idem
8. Universidade Estadual do Maranhão- UEMA	idem	idem
10. Fundação de Amparo à Pesquisa do Maranhão- FAPEMA	idem	idem
11. Universidade Federal do Maranhão- UFMA	idem	idem
12. Universidade do Tocantins- UNITINS	idem	idem
13. Universidade de Brasília- UnB	Dec 96	Adriana Moreira
14. Universidade Federal do Acre- UFAC	Nov 96	Foster Brown
15. Centro de Pesquisa Agroflorestal/ EMBRAPA- Acre CPAF-AC	Dec 96	Foster Brown
16. Fundação Tecnológica do Estado do Acre- FUNTAC	Jan 97	Foster Brown
17. Universidade Federal de Mato Grosso- UFMT	Jan 97	Foster Brown
18. Instituto de Terra de Mato Grosso- INTERMAT	Jan 97	Foster Brown
19. Zoneamento Socio-economico e Ecologico- ZSEE, Mato Grosso	Jan 97	Foster Brown
20. Foundation Estadual do Meio Ambiente de Mato Grosso - FEMA	Jan 97	Foster Brown
21. Universidade Federal de Rondonia - UNIR	Jan 97	Foster Brown
22. Centro de Pesquisa Agroflorestal/ EMBRAPA - Rondonia- CPAF-RO	Jan 97	Foster Brown
23. Companhia de Pesquisa de Recursos Minerais - CPRM	Jan 97	Foster Brown
24. Instituto Nacional de Pesquisas da Amazônia - INPA	Nov 96	Antonio Nobre
25. Fundação Universidade da Amazonas - FUA	March 97	Foster Brown

Appendix I.
**Preliminary Report of the Workshop on Training and Education of the Large
Scale Biosphere-Atmosphere Experiment in Amazonia (LBA)**
Manaus, 23-27 March 1997

**for the Scientific Steering Committee of the
Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA)**
2 April 1997

Mid-wives: F. Brown, A. Moreira, A. Nobre, L. Martinelli, P. Artaxo, D. Alves, T. Sa, J. Marengo, A. Ramirez, C. Diniz, and R. Castela

Introduction

This workshop had three objectives: a) Define a training and education program for the Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) for 1997 and 1998; b) Develop a network of educators and researchers in Amazonia that will contribute to LBA activities; and c) Provide background material and information on LBA science and global change that participants can use in their home institutions to multiply the effect of the workshop.

Objective a) is addressed in items 1, 2, 3, and 5 below. Objective b) is a direct result of the participants meeting one another and is treated in items 3, 4, 5 and 6. The last objective concerning background material was met by distributing to representatives the previous reports, copies of the book entitled *The Next 100 Years* in Portuguese, and sets of transparencies on LBA developed by the NASA Project Office.

Thirty-six participants were invited, 45 attended. They came from nine countries: Bolivia, Brazil, Colombia, Ecuador, Panama, Peru, Venezuela, Germany, and the U.S. Twelve institutions from the Brazilian Amazon and Cerrado were represented. Also participating were representatives from three Pan-Amazon institutions, UNAMAZ (Universidades da Amazonia), CATHALAC (Centro del Agua del Trópico Húmedo para América Latina y el Caribe) and IAI (Inter-American Institute for Global Change Research), as well as from NASA and the European Union.

The meeting was hosted by INPA (Instituto Nacional de Pesquisas da Amazonia) and held at the Hotel Tropical in Manaus. The workshop began with a field trip to orient participants as to the field component of LBA. Major financial support came from the National Aeronautics and Space Administration (NASA).

Results of the Workshop

The Workshop addressed four principal topics: 1) training and education activities for 1997 and 1998; 2) guidelines for the NASA-Ecology Research Announcement (NRA); 3) a program for Amazon Pact countries outside of Brazil; and 4) a program for Brazilian Amazon/Cerrado universities and research institutions. The work groups on these topics were asked to answer the following questions: Who will write the proposal/ program? Who will run the program? How will it be done? When will the program begin/end? How much will the program cost and who could finance it?

1. Training and education activities for 1997 and 1998 (L. Martinelli, P. Artaxo, and D. Alves)

This component is subdivided into 11 training courses over the next two years, CNPq-RHAE Program, and CNPq-Induced Area Ph.D. Program.

1.1. Training Courses (Luiz Martinelli). Five courses are planned from now through June 1998. Four of these courses have the objective of providing background knowledge in thematic areas of LBA and the basic techniques that will be used in research. A fifth course involves specific training in tower techniques. The courses, the likely site, and possible coordinators are as follows:

Course 1 - Carbon, Biogeochemistry and Ecology (Brasilia, UnB, Heloisa Miranda, Adriana Moreira, Niro Higushi, Alex Krusche, Luiz Martinelli); Course 2 - Climate and Atmospheric Chemistry (Sao Paulo, USP, Pedro Dias, Fabio Gerab, Jose Marengo, Plinio Alvala, Edson da Rocha, Tania Tavares); Course 3 - Land Use Change and Remote Sensing (Sao Jose dos Campos, INPE, Diógenes Alves, Getulio Batista, Eraldo Matricardi, Irving Foster Brown, Adriano Venturieri); Course 4 - Surface Hydrology and Water Chemistry (Piracicaba, CENA, Reynaldo Victoria, Javier Tomasella, Bruce Forsberg, Eliomar Santos Filho, Yara Weissberg, Marcio Santos); Course 5 - Operation of Micrometeorological Towers (Manaus, INPA, Antonio Nobre, Antonio Miranda and Humberto Rocha).

The second phase of courses will be from July 1998 to December 1999 with locations undefined: Course 6 - Use of Stable Isotopes in Environmental Studies (Reynaldo Victoria, Luiz Martinelli, Marcelo Moreira), Course 7 - Sampling, Analysis, and Modelling of Trace Gases and Aerosols (Paulo Artaxo, Marisa Piccolo, and Brigitte Feigl); Course 8 - Acquisition and Analysis of Data (GIS, DIS), Course 9 - Operation of Radiosondes; Course 10 - Modelling 4DDA; Course 11 - Field Techniques. The coordinators listed above will be responsible for the logistics, content, and selection of candidates, jointly with the Committee for Education and Training (CET). The CET will be responsible for procuring funds for these courses from sources such as ENRICH, FAPESP, CNPq and IAI.

About 20-25 participants will attend each course, of which 10 participants will be nationals from Amazon Pact countries outside Brazil. These latter participants will be financed by IAI and/or ENRICH. Dr. Armando Ramirez of Venezuela (UCV) was invited to coordinate the selection process of these candidates. The major institutions in Amazonia and other Brazilian institutions involved in LBA will be invited to suggest candidates for the courses. The selection of candidates will be done by the course coordinators jointly with the members of CET.

1.2 CNPq-RHAE fellowships (Diógenes Alves). The RHAE (Human Resources in Strategic Areas) is a program that the National Research Council of Brazil (CNPq) has developed for capacity building in specific areas, such as environmental studies. Initial contact with CNPq representatives indicated that the 6.5 million dollars over a seven-year period is not unreasonable amount for RHAE funding.

The distribution of required fellowships is sketched out below:

Table 1. The estimated number of scholarships and fellowships necessary for full functioning of LBA.

AREA	Ph.D.	MSc	Technicians (recent grad.)	DTI (M/D)	Visit Res.	UG Interns	sub-total
Land Use/Cover Change	3	5	4			4	16
Carbon Dynamics	4	4	6			8	22
Biogeochemical Cycles	3	4	3			6	16
Atmospheric Chemistry	4	2	6			2	14
Hydrology	5	4	3			5	17
Remote Sensing	5	7	8			6	26
Meteorology	4	5	10			6	25
Ecology	3	4	6			5	18
sub-total	31	25	46	25	10	42	179

The costs of these fellowships/scholarships is based on the following calculations:

Table 2. Costs associated with Table 1.

	Number of persons	Annual cost	Duration (years)	Total (US\$ millions)
Ph.D.	31	18.000,00	4	2.232
MSc	25	12.000,00	2.5	0.750
DTI	25	18.000,00	4	1.800
Visit	10	36.000,00	---	0.360
Technician	46	12.000,00	2	1.104
Scientific Initiation	42	3.000,00	2	0.252
	179		Total	6.498

Luiz Martinelli offered to sketch the outline of the RHAE proposal during the next few weeks. Implementation could be done by the LBA office in Brazil. The question of what institutions would receive what RHAE fellowships was not resolved.

1.3. CNPq-Induced Area Ph.D. scholarships in Global Change. (Paulo Artaxo)

The National Council of Research in Brazil (CNPq) has instituted a new program for Ph.D. scholarships, called 'Induced Areas' (Áreas Induzidas), where the funds are concentrated in thematic areas. These can take the form of Ph.D. and post-Ph.D. scholarships at foreign universities, "sandwich" scholarships within Brazil where a student studies at one university and does research at another, and sandwich scholarships with foreign research institutions. The following U.S. institutions were listed as possible centers for human resource development in Global Change, with possible contact persons and areas of concentration listed: University of California at Santa Barbara (Profs. J. Dozier, John Melack, Leal Mertis, and Tom Dunne (Hydrology)); Harvard University (Profs. Daniel Jacob, Steve Wofsy (Atmospheric Chemistry)); Massachusetts Institute of Technology (Prof. Reginald Newell, Rafael Bras, Ron Prinn, Peter Stone, Meteorology, Hydrology and Atmospheric Chemistry); University of New Hampshire (Profs. John Aber, Berrien Moore, David Skole, Charles Vorosmarty, Robert Talbot, Patrick Crill, Land Use/Cover Change, Biogeochemical Cycles, Atmospheric Chemistry); Princeton University (Profs. Jorge Sarmineto, Sokiuro Manabe, Biogeochemical Cycles, Meteorology); Stanford University Profs. Peter Vitousek, Hal Mooney, and Chris Field (Ecology and Biogeochemical Cycles); University of Washington, Seattle (Profs. Jeff Richey, Peter Hobbs, Robert Charlson, John Hedges, Allan Devol, Dennis Letternmeier, and Robert Harrison, Hydrology, Atmospheric Chemistry, Ecology); University of Maryland/NASA Goddard (Steve Prince, Yoram Kauffman,

Max Soares, Bill Lau, Forest Hall, Jim Tucker, Land Use/Cover Change, Atmospheric Chemistry, Meteorology).

Brazilian universities and institutions with capacity for receiving students in global change studies for LBA: Instituto Nacional de Pesquisas Espaciais - INPE (Land Use/Cover Change, Meteorology, Remote Sensing, Atmospheric Chemistry); Universidade de São Paulo - USP (Paleoclimatology, Hydrology, Meteorology, Atmospheric Chemistry and Physics, Biogeochemical Cycles, Ecology, Agrometeorology, Land Use/Cover Change); Instituto Nacional de Pesquisas da Amazonia - INPA (Ecology and Biogeochemical Cycles); Universidade Federal do Pará - UFPa (Socio-economic aspects of Land Use/Cover Change); Museu Paraense Emílio Goeldi - MPEG (Socio-economic aspects of Land Use/Cover Change); Universidade de Brasília - UnB (Biogeochemical Cycles, Ecology, Socio-economic aspects of Land Use/Cover Change); Universidade Federal Fluminense -UFF (Biogeochemical Cycles, Paleoclimatology); Universidade Estadual de Campinas - UNICAMP (Biodiversity and Socio-economic aspects of Land Use/Cover Change).

For sandwich scholarships with foreign research institutions, the following institutions were selected: National Aeronautics and Space Administration NASA (Goddard Space Flight Center -GSFC, Langley Research Center - LARC); Woods Hole Research Center; Ecosystem Center at the Marine Biological Laboratory; National Center for Atmospheric Research - NCAR; United States Forest Service - USFS; Institute of Tropical Forestry in Puerto Rico.

Paulo Artaxo offered to write the proposal and will complete it in the coming weeks. Its operation could be done via the LBA office. If approved, CNPq will provide the funding. Presumably it will become operational by the end of this year.

2. Guidelines for the Training and Education Plan in the NASA-Ecology NRA (Tatiana Sá).

The NRA for NASA-Ecology has made new requirements on proposals for this component of LBA: *"...Due to the breadth of topics addressed -- from nutrient cycling processes to the drivers of land use change -- developing the specific capacity of host-country researchers will be addressed best within a specific investigation. Thus, each LBA-Ecology proposal should explicitly address how the investigation will contribute to training and education."* (Section E. LBA-Ecology Science Themes, 8. Training and Education In <http://www.hq.nasa.gov/office/mtpe/nra97mtpe02/nra9702.html>).

As this is a new theme, the participants of the Workshop made the following suggestions for those preparing proposals:

- 1) Principal Investigators (P.I.s) at U.S. institutions could offer to advise students from countries/institutions involved in LBA (master, Ph.D. or Post- Ph.D.);
- 2) P.I.s could give courses or provide training activities in Brazil on topics relevant to NASA-Ecology. These activities should be directed to researchers, professors and students in Amazonian countries and in institutions involved in LBA (short training and graduate courses, classes in undergraduate and graduate programs);
- 3) P.I.s could provide training opportunities during intensive field campaigns for researchers and students at institutions associated with LBA,;
- 4) P.I.s could open internships for participation of researchers and students at LBA-affiliated institutions during the phases of data processing and analysis;
- 5) P.I.s could provide short training programs at U.S. institutions for researchers, professors and students of institutions associated with LBA;
- 6) P.I.s should consider the elaboration of material related to global change and its dissemination to strategic segments of society (policy makers, teachers, funding agencies, and decision makers). These could be in the form of brochures, CD-ROMS, videos, lectures, seminars, and 'field days;'

- 7) The activities of items 1-6 should be done in coordination with the Committee of Education and Training (CET) of LBA, as well as with other projects and programs;
- 8) Educational training materials should be disseminated via an administrative structure to be established at the level of LBA (Environmental education at various levels, and initiatives for specific groups such as decision makers, teachers, etc.).

The P.I.s should write the plans with help of the CET and regional representatives. Given that details will depend on what projects are approved, the following steps can be taken at present: mobilization of potential participants at regional institutions; elaboration and distribution of material on global change and the proposal (via LBA structure); informal contacts using email; recruitment, selection, and training; evaluation of the results of education and training activities; articulation of a strategy to guarantee the continuity of education and training activities after the end of LBA. The period of the activities should begin now and terminate one year after the end of LBA research activities. Financial support should come from NASA, and national financial agencies (scholarships, etc.). Cost: US\$5 million(?).

3. Program of training and education for Amazon Pact Countries outside of Brazil (Jose Marengo and Armando Ramirez). The basic training will be conducted jointly with that proposed in 1, with each of the Amazon Pact countries outside of Brazil suggesting two candidates each. Additional funding for scholarships is available. For example, the Tratado de Cooperação Amazônica (TCA) offers two scholarships for graduate studies at INPA. UNAMAZ administers similar scholarships with support from Germany (DAAD). IAI support is dependent on proposals from ratifying countries. The group suggested that the IAI proposal be written by CPTEC (with Carlos Nobre as P.I.) and with co-P.I.s members of the CET plus representatives from Peru and Venezuela (IAI-ratifying countries). Participants from the five Amazon Pact countries outside of Brazil will provide a list of the institutions and universities that could potentially participate.

The representatives also issued a "Statement of Intent of Amazon Pact Nations to Assume a More Active Role in Activities of the Large-Scale Biosphere-Atmosphere Experiment in Amazonia." Also presented were an outline of a Tower proposal from the Ecuadorian Committee of LBA and a proposal for the ALFA Network.

4. Program of Amazonian Universities (Brazilian) Midwives: Cristovam Diniz (UFPa) and Reginaldo Castela (UFAC), with Antonio Nobre (INPA), Vera Reis (UNITINS), José Nogueira (UFMT), Manoel Tourinho (FCAP), and Adriana Moreira (UnB)

The group, representing six Amazonian and one Cerrado institutions, considered that the Project for Research and Graduate Studies in the North Region (PNOPG) should act as the principal approach to strengthen institutional participation in LBA activities. This program is already working in several institutions and involves all educational levels, from primary school to Post-Doctoral. Of particular concern is stabilization of trained personnel in these institutions. The funding sources for this project are CNPq, CAPES, FINEP and the proper institutions of higher education. There are two deadlines each year: February and August.

The program to be proposed focuses on Global Change and thus incorporates the LBA experiment. The group evaluated the human resource needs at 10 Amazonian and Cerrado universities, as show in Table 3. The basic unit is a research group, composed of one Ph.D., two M.Sc., one specialist, one technician, and four undergraduate interns, for a total of nine persons

per research group. The x in the table signifies a research group that needs to be constituted at a given university. The total number of groups is 53, equivalent to 477 persons (50+ Ph.Ds and 100+ M.Sc).

Table 3. Human Resource Needs for Brazilian Amazonian Universities for a Program in Global Change. Each x represents a research group (1 Ph.D., 2 M.Sc., 1 Esp. 1 Technician, 4 undergraduate interns = 9 persons)

AREA	UFPa	UFAC	UNIR	UFMT	UNI-TINS	FCAP	UNB	UNIF-AP	UFMA	FUA	sub-total
LUCC	x	x	x	x	x	x	x	x	x		9
Carbon	x	x	x	x	x	x	x		x	x	9
Biogeochem.	x	x	x	x	x	x	x		x	x	9
Atm. Chem.	x			x						x	3
Hydrol.	x		x	x	x				x	x	6
R.Sens.	x	x	x	x	x	x		x	x	x	9
meteorol.	x	x	x	x	x	x			x	x	8
sub-total	7	5	6	7	6	5	3	2	6	6	Total: 53

UFPa = Federal University of Para, UFAC= Federal University of Acre, UNIR=Federal University of Rondonia, UFMT= Federal University of Mato Grosso, FCAP= Faculty of Agrarian Ciencias of Para, UNB=University of Brasilia, UNIF-AP= Federal University of Amapa, UFMA = Federal University of Maranhao, FUA = Federal University of Amazonas.

The recommendations of the group are as follows:

1. To install a general coordination work-group with a member from every interested institution. Those present become *de facto* members of this group.
2. The LBA coordinating group should ask the Deans of Research and Graduate Studies or their equivalents at the various institutions to become the institutional representatives and to delegate their authority to this work-group.
3. The time table is the following:

Until 30 April to meet and consolidate the following data:

- a) local leaders
- b) area of activities
- c) infrastructure available
- d) institutional needs
- e) letter of intent from the institution

The integrated proposal will need to be submitted to CNPq and other agencies by August. Preliminary cost estimate is on the order of 1-2 million dollars/yr.

5. Continuing Activities

1. Plan and Coordinate Courses (Luiz Martinelli - Proposal, administration to be defined)
2. Write CNPq -Induced Area in Global Change Proposal (Paulo Artaxo)

3. Write CNPq RHAE Global Change Proposal (Luiz Martinelli & Carlos Nobre, administration to be defined)
2. Serve as intermediary between P.I.s of NASA-Ecology RA and regional researchers/students (to be defined)
3. Coordinate dissemination of LBA & Global Change Science to universities, decision makers, teachers (to be defined)
4. Link education activities in all Amazon Pact Countries (UNAMAZ)
5. Help develop Global Change Program in Amazonian universities (Reginaldo Castela, Vera Reis, Jose Nogueira, Adriana Moreira)
6. Dissemination of LBA and Global Change Science - Adriana Moreira, Mario Amin, and CATHALAC.
7. Continue regional activities of dissemination. Eastern Amazon (Tatiana Sa, Iara Weissberg, Márcio dos Santos, Robério Nobre, Vera Reis). Central Amazon (Antonio Nobre, Niro Higuchi, EMBRAPA representatives). Western Amazon (Reginaldo Castela, Eliomar Silva Filho, Jose Nogueira), Cerrado (Heloisa Miranda, Vera Reis, Jose Nogueira).

Key Issue: the activities of the Committee of Education and Training need to be institutionalized. Some possibilities are:

- a) Operation and Implementation Committee
- b) LBA Office
- c) Committee of Education and Training, also involving NASA and EC

6. List of participants, their institutions and contact email/telephone

Adriana G. Moreira	Woods Hole Research Center	adriana@whrc.org
Anne Jochum	DLR	ajochum@arrakis.es
Antonio Donato Nobre	INPA	anobre@cr-am.mp.br
Armando J. Ramirez	Univ. Central de Venezuela	605 2154 / 605 2169
Brad Wilcox	IAI	bwilcox@dir.iai.inf
Bruce Forsberg	INPA	fbruce@internext.com.br
Bruce Nelson	INPA	bnelson@internext.com.br
Carlos A. Llerena	Univ. Nac. Agraria La Molina	callfcl@redinf.edu.pe
Carlos Nobre	CPTEC - INPE	nobre@cptec.inpe.br
Celso Paulo de Azevedo	CPAA / EMBRAPA	Tele/Fax: 55 92 622 2012
Cristovam W. P. Diniz	UFPA	cdiniz@marajo.secom.ufpa.br
Diogenes S. Alves	INPE	dalves@dpi.inpe.br
Donald W. Deering	NASA GSFC	ddeering@hpmail.gsfc.nasa.gov
Eduardo A. Vieira Morales	CPAA - EMBRAPA	Tele/Fax: 55 92 622 2012
Eliomar P. da Silva Filho	Univ. Federal de Rondônia	Eliomar@ronet.com.br
Elisa Vieira Wanderlei	CPAA / EMBRAPA	euterpe@cr-am.br
Flávio J. Luizão	INPA	litter@cr-am.mp.br
Foster Brown	WHRC/UFF/UFAC	fbrown@whrc.org
Gonzalo Hurtado	IDEAM - Colombia	gonzah@ideam.gov.co

Heloisa Sinatora Miranda
 Hideo Hiramatsu
 Iara Weissberg
 Irving Foster Brown
 Jeffrey Richey
 José A. Marengo
 José da S. Seráfico Carvalho
 José de Souza Nogueira
 Laura M. Mcshane
 Laureno Andrade
 Luis Alberto Morgan Hay
 Luiz Antonio Martinelli
 Manoel Tourinho
 Márcio C.F.V. dos Santos
 Mario M. Amin
 Martin Ruzek
 Michael E. McClain
 Michael Keller
 Niro Higuchi
 Paulo Artaxo
 Reginaldo F.F. de Castela
 Robério A.A. Nobre
 Roberval M. B. de Lima
 Tatiana Deane de Abreu Sá
 Timothy J. Killeen
 Vera Lucia Reis

Universidade de Brasília
 CPAA - EMBRAPA
 Museu Paraense Emilio Goeldi
 WHRC/UFF/UFAC
 Universidade de Washington
 CPTEC/INPE
 Fundação Djalma Batista
 Univ. Federal de Mato Grosso
 NASA - Goddard Space Center
 Esc. Politecnica Nac.-Ecuador
 CATHALAC
 CENA/USP
 FCAP
 Univ.Fed. do Maranhão
 UNAMAZ
 USRA
 University of Washington
 Institute of Tropical Forestry
 INPA
 Universidade de São Paulo
 Universidade Federal do Acre
 Sec. do Meio Amb. do Amapá
 CPAA/ EMBRAPA
 CPATU / EMBRAPA
 Museo Noel Kempff - Bolivia
 Unitins

hmiranda@guarany.cpd.unb.br
 cpaa@cr-am.mnp.br
 weissberg@goeldi.museu-goeldi.br
 fbrown@whrc.org
 jrichey@u.washington.edu
 marengo@cptec.inpe.br
 serafico@manaus.pegasus.com.br
 nogueira@cpd.ufmt.br
 lmcshane@ltpmail.nasa.gov
 landrade@mail.epn.edu.ec
 cathalac@sinfo.net
 zebu@cena.usp.br
 varzea@datanetbbs.com.br
 marciobr@br.homeshopping.com.br
 amin@amazon.com.br
 ruzek@usra.edu
 mcclain@u.washington.edu
 0003950184@mcimail.com
 niro@cr.am.mnp.br
 artaxo@if.usp.br
 55-68-229-2244
 Tele/Fax: 55 96 223 5771
 Tele/Fax: 55 92 622 2012
 tatiana@nautilus.com.br
 davis@mitai.nrs.bolnet.bo
 unitins@cnpq.br